U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration
Defense Nuclear Nonproliferation

Global Threat Reduction Initiative

U.S.-Origin Nuclear Fuel Removals

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GTRI Mission and Goals

DOE STRATEGIC GOAL 2.2

Prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction and other acts of terrorism

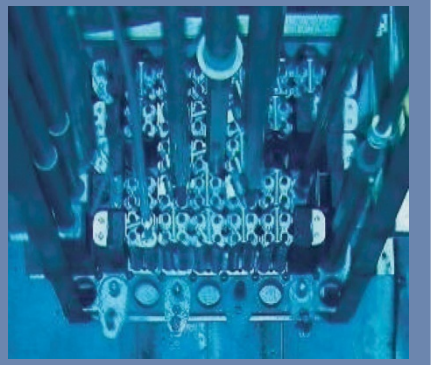
GTRI MISSION

Reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide.

GTRI is:

- A part of President Obama's comprehensive strategy to prevent nuclear terrorism; and
- The key organization responsible for implementing the U.S. HEU minimization policy.

Convert



Convert research reactors and isotope production facilities from the use of highly enriched uranium (HEU) to low enriched uranium (LEU)

These efforts result in permanent threat reduction by minimizing and, to the extent possible, eliminating the need for HEU in civilian applications – each reactor converted or shut down eliminates a source of bomb material.

Remove

Remove and dispose of excess nuclear and radiological materials; and

These efforts result in permanent threat reduction by eliminating bomb material at civilian sites – each kilogram or curie of this dangerous material that is removed reduces the risk of a terrorist bomb.

Protect

Protect high priority nuclear and radiological materials from theft and sabotage

These efforts result in threat reduction by improving security on the bomb material remaining at civilian sites – each vulnerable building that is protected reduces the risk until a permanent threat reduction solution can be implemented.

Context

Presidential Speech in Prague – April 5, 2009

"Today, I am announcing a new international effort to secure all vulnerable nuclear material around the world within four years. We will set new standards, expand our cooperation with Russia, and pursue new partnerships to lock down these sensitive materials."

Context

Nuclear Security Summit
April 12 & 13th, 2010

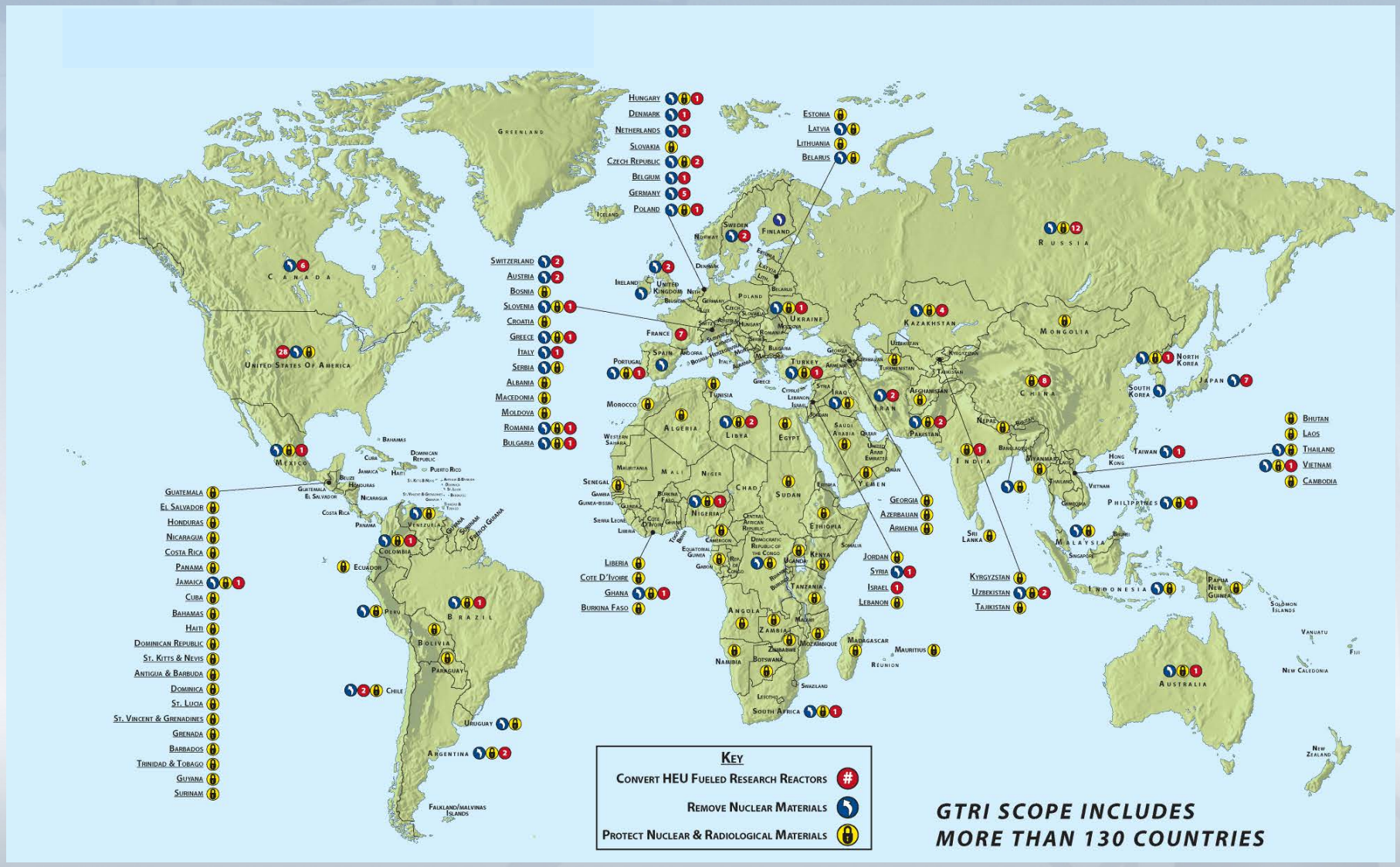
"We recognize that highly enriched uranium and separated plutonium require special precautions and agree to promote measures to secure, account for, and consolidate these materials, as appropriate; and encourage the conversion of reactors from highly enriched to low enriched uranium fuel and minimization of use of highly enriched uranium, where technically and economically feasible."

2012 Nuclear Security Summit

- The 2012 Nuclear Security Summit evidenced some unprecedented outcomes: Participating nations fulfilled approximately 90 percent of their voluntary 2010 summit commitments, resulting in the reduction of vast amounts of highly enriched uranium, numerous reactor conversions, and a series of anti-smuggling initiatives.
- Despite these great success, the President remains concerned:

"Of course, what's also undeniable is that the threat remains. There are still too many bad actors in search of these dangerous materials, and these dangerous materials are still vulnerable in too many places. It would not take much -- just a handful or so of these materials -- to kill hundreds of thousands of innocent people. And that's not an exaggeration; that's the reality that we face."

GTRI World Wide Scope



GTRI Removal Activities

Status: 5,221 kilograms to be removed by 2016;
3,335 completed (64%) (total program)

- Russian-origin: 2,488 kilograms by 2016; 1,751 completed (70%)
- US-origin: 1,654 kilograms by 2016; 1,261 completed (76%)
- Gap-material: 1,079 kilograms by 2016; 323 completed (29%)
- **All HEU material has been removed from 21 countries** Brazil, Bulgaria, Chile, Colombia, Denmark, Greece, Latvia, Libya, Philippines, Portugal, Romania, Serbia, Slovenia, South Korea, Spain, Sweden, Taiwan, Thailand, Turkey, Ukraine and Mexico.
- **Completed clean-out of HEU from of 8 countries since the President's April 2009 speech in Prague -** Romania (June 2009), Taiwan (September 2009), Libya (December 2009), Turkey (January 2010), Chile (March 2010), Serbia (December 2010), Mexico (March 2012) and Ukraine (March 2012).

Casks of HEU spent nuclear fuel being loaded for transportation from Latvia back to Russia, May 2008

South African spent nuclear fuel being loaded next to operating reactor pool

U.S.-Origin and Gap Remove Program Shipments

- **62 shipments completed (3 Gap)**
- **50 via Ocean to East Coast**
- **6 shipments from Canada**
- **9,563 spent fuel assemblies, from 32 countries**
- **10 cross-country shipments completed including one west coast shipment**
- **233 casks/7,995 assemblies to SRS**
  21 casks/1,503 rods to INL
  25 casks/65 assemblies to Y-12

U.S.-Origin Nuclear Removal Objective

Goal: Remove or dispose of excess WMD-usable U.S.-origin nuclear materials located at civilian sites worldwide:

- Reduce and, to the extent possible, eliminate the use of HEU from civilian nuclear applications
- Disposition LEU spent fuel as an incentive for foreign reactor operators to convert from HEU to LEU fuel
- Allow time for countries with spent fuel (both HEU and LEU) containing uranium enriched in the United States to resolve their own disposition

These efforts result in permanent threat reduction because each kilogram of this dangerous material that is secured and disposed of removes it from possible diversion for malevolent purposes.

Gap Removal

Scope: Facilitate the disposition of high risk, vulnerable nuclear material not covered by other removal efforts if the required conditions are met. The materials could include:

- U.S.-origin spent nuclear fuel not covered by the existing U.S.-origin fuel return program
- HEU material of non-U.S.-origin and non-Russian-origin
- U.S.-origin HEU fresh research reactor fuel
- Separated plutonium

Accomplishments:

Since the program began in 2006, approximately 323 kilograms of HEU and plutonium have been removed from Belgium, Canada, Chile, Italy, the Netherlands, Sweden and other countries

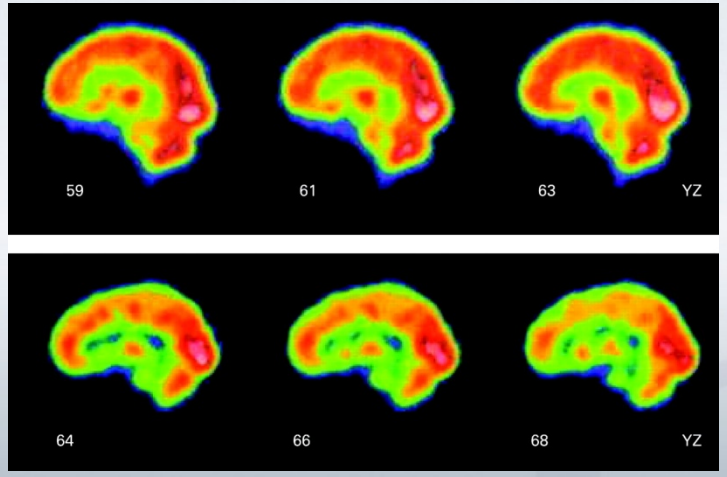
Canadian HEU Minimization

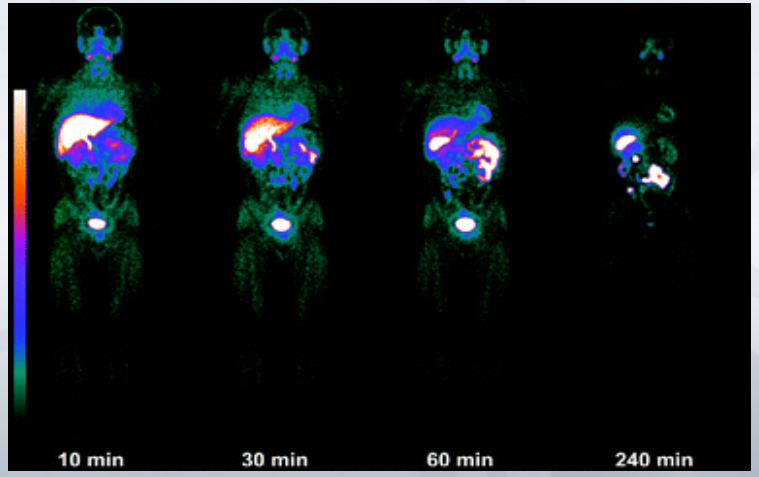
- Canadian Nuclear Research Reactors
  - Most research reactors have converted to use LEU fuel
  - Support international nuclear research
  - Provides the majority of medical isotopes to the US consumer

- GTRI is currently coordinating with the Canadians to minimize the amount of HEU stored within Canada to reduce the amount of proliferation sensitive material.
  - GTRI does not consider irradiated nuclear fuel or target material residue to be waste, but rather material that requires disposition in a safe and secure manner
  - The US DOE has the only facility equipped to safely receive and dispose of this HEU material
  - DOE believes that the transfer of this material to DOE facilities for permanent disposition to be the best interest of both residences of Canada and the united States for long-term safety and security.

Mo-99 Production and Usage

- MO-99 Production Background
  - Foreign research reactors produces 100% of the U.S. supply of Mo-99. Canada currently supplies approximately 60% of this important radiopharmaceutical. Mo-99 is used to generate Tc-99m.
  - ~ 1 in 13 residents will receive nuclear medicine procedures from this material this year
- Medical Usage
  - Tc-99m is used in approximately 80 percent of all nuclear medicine diagnostic procedures, and in roughly 50,000 diagnostic and therapeutic nuclear medicine procedures performed daily in the United States, including diagnosis of heart disease, treating cancer, and studying organ structure and function.
  - Canada also produces other medical isotopes for the U.S. such as Iodine-131 and Xenon-133.





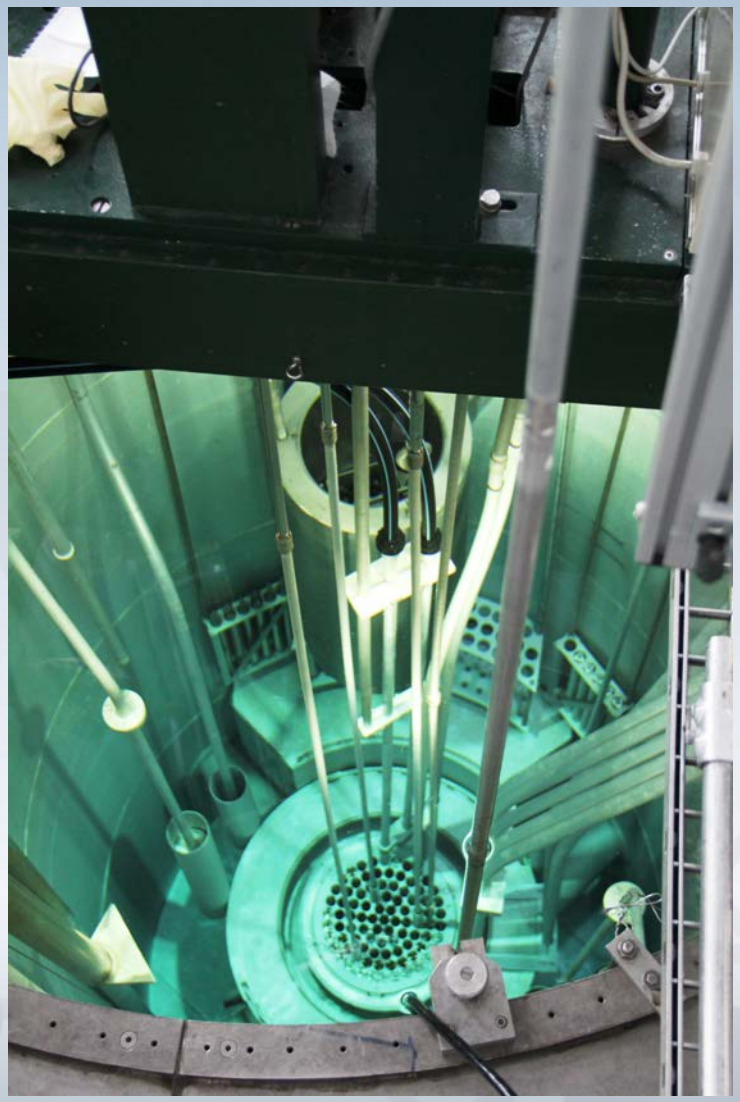
Shipment Coordination in the United States

- Our office works directly with Cort Richardson of the Council of State Governments - Eastern Regional Conference and Chris Wells of the Southern States Energy Board. Mr. Richardson is very active with out Canadian shipments and Mr. Wells is active in both our Canadian shipments and all shipments that arrive through the port of Charleston, South Carolina.
- The GTRI program could not perform its function without the close communication and cooperation with our state partners and their coordinating representatives.
- We have a particularly strong relationship with the State of South Carolina including groups such as the S.C. Law Enforcement Division, S.C. Emergency Management Division, S.C. Department of Health and Environmental Control and S.C. Department of Natural Resources.
- Coordination with multiple Federal agencies is necessary.

Recent Shipment of Note

- GTRI completed a project to receive the last known HEU training, research, isotope-General Atomics (TRIGA) research reactor fuel not currently stored at the Idaho National Laboratory (INL). The fuel was received at INL from Austria in a joint shipment to include irradiated fuel from Italy that was received at the Savannah River Site (SRS).

- DOE provided lightly irradiated TRIGA research reactor fuel previously stored at INL to the Atominstitut at the Vienna University of Technology while returning all HEU TRIGA fuel and other spent LEU fuel.



Recent Shipment

Upcoming Shipments

- The next year will be average for GTRI. We are expecting shipments from:
  - Canada
  - Switzerland
  - United Kingdom

- As the U.S. Nuclear Remove Program nears its end in May of 2019, we expect the pace of shipments to increase. We are already working with our foreign partners to plan accordingly.

Robust Shipping Containers

- What kind of container are these types of materials transported in?
- What standards are they built to and how are they evaluated?

Robust Shipping Containers

- All casks conform to IAEA standards
  - NRC verifies cask design meets IAEA TS-R-1
  - Certificate of Competent Authority issued by USDOT
- Tests performed in sequence
  - 30 foot drop onto flat unyielding surface
  - 40 inch free drop onto 6 inch diameter steel rod at least 8 inches long at weakest point
  - Totally engulfed in fire 1475 degrees for 30 minutes
  - Completely submerged 3 ft. of water for 8 hours
- Separate test immersed under 50 ft. water for 8 hours

Source Recovery

- Capability to transport sources jointly with U.S.-Origin or Gap Remove and Off-Site Source Recovery Program
  - Particularly PuBe sources which can not be transported by air
  - To learn more and/or register online, please visit: http://osrp.lanl.gov
- GTRI highly encourages partner countries and reactor operators to work with neighbouring countries interested in disposing of sources to share the dedicated vessel to be used in the spent fuel shipment
  - Provides an opportunity for overall cost savings when compared to two separate shipments
  - Allows for international cooperation in securing nuclear and radiological materials

Conclusion

Thank you for inviting us to speak to you.

Questions?